

# Interannual Variation of the Indonesian Throughflow Transport Estimated by Wind Stress and Adjoint Sensitivity

**Tong Lee, Ralf Giering, Benny Cheng**

Jet Propulsion Laboratory, California Institute of Technology

The sensitivity of annual-mean transport of the Indonesian throughflow (ITF) to annual-mean wind stress in a global ocean general circulation model (OGCM) is obtained by the adjoint of the OGCM. Interannual variation of ITF transport is estimated from the global inner product of this sensitivity function and interannual anomaly of NCEP reanalyzed wind stress from 1980-1997. The estimated interannual ITF transport is well correlated with values simulated by the forward OGCM and qualitatively consistent with previous estimate based on XBT data. Significantly correlation is found between the estimated ITF transport anomaly and interannual variation of sea surface temperature in the central to eastern equatorial Pacific: the ITF tends to be weaker during El Niño and stronger during La Niña.

Regional contribution of wind stress to ITF transport on interannual time scales is examined. The largest contribution comes from wind over the equatorial Pacific and coastal region southwest of Java. Secondary contribution is found from wind over the western tropical Indian Ocean, coastal areas off western Australia, New Zealand, and South America. Indian Ocean wind has a smaller contribution to ITF than the Pacific wind does, and tends to counteract the later. This is because zonal wind anomalies over the tropical Pacific and Indian Oceans tend to have opposite signs on interannual time scales, reflecting varying intensity of the Walker circulation cells over the two tropical oceans (having opposite sense of rotation) associated with El Niño - Southern Oscillation. ITF transport variation estimated from wind over the domain defined by Godfrey's "Island Rule" is substantially weaker than that obtained from global wind. Contribution missing from the original "Island rule" include wind forcing off Java and in the western tropical Indian Ocean, and the northern part of the equatorial Pacific up to the Inter-tropical Convergence Zone.